

### **Brief Description of the Drawings**

- [0005] FIG. 1 is a side view of a one-step wedge thread form in accordance with an embodiment of the invention;
- [0006] FIG. 2 is a side view of a two-step wedge thread form in accordance with an embodiment of the invention;
- [0007] FIG. 3 is a side view of a two-step wedge thread form in accordance with an embodiment of the invention;
- [0008] FIG. 4a shows a torque shoulder in accordance with an embodiment of the invention;
- [0009] FIG. 4b shows a torque shoulder in accordance with an embodiment of the invention;
- [0010] FIG. 4c shows a torque shoulder in accordance with an embodiment of the invention;
- [0011] FIG. 4d shows a torque shoulder in accordance with an embodiment of the invention;
- [0012] FIG. 5a shows a metal-to-metal seal in accordance with an embodiment of the invention;
- [0013] FIG. 5b shows a metal-to-metal seal in accordance with an embodiment of the invention;
- [0014] FIG. 5c shows a metal-to-metal seal in accordance with an embodiment of the invention;
- [0015] FIG. 5d shows a metal-to-metal seal in accordance with an embodiment of the invention;
- [0016] FIG. 5e shows a metal-to-metal seal in accordance with an embodiment of the invention;

- [0017] FIG. 6a shows a combination of a torque shoulder with a metal-to-metal seal in accordance with an embodiment of the invention;
- [0018] FIG. 6b shows a combination of a torque shoulder with a metal-to-metal seal in accordance with an embodiment of the invention;
- [0019] FIG. 6c shows a combination of a torque shoulder with a metal-to-metal seal in accordance with an embodiment of the invention;
- [0020] FIG. 6d shows a combination of a torque shoulder with a metal-to-metal seal in accordance with an embodiment of the invention;
- [0021] FIG. 6e shows a combination of a torque shoulder with a metal-to-metal seal in accordance with an embodiment of the invention;
- [0022] FIG. 6f shows a combination of a torque shoulder with a metal-to-metal seal in accordance with an embodiment of the invention.

### Detailed Description

- [0023] Referring to the drawings wherein like reference characters are used for like parts throughout the several views, FIGS. 1-3 illustrate a cross section of the wedge thread of a pin member and a box member in accordance with embodiments of the invention. As shown in FIG. 1, in one embodiment, the invention is a one-step wedge thread form with a positive stop torque shoulder. The positive stop torque shoulder can be located at the interface of the pin nose/box inner diameter (ID) shoulder, as shown in FIG. 1, or located at the interface of the box face/pin outer diameter (OD) shoulder.
- [0024] Connection 8 includes a box member 10 and a pin member 12. Box member 10 has a tapered, internal, generally dovetail-shaped thread structure formed thereon and adapted for engaging complementary tapered, external,

generally dovetail-shaped thread structure formed on pin member 12 to mechanically secure the box and pin members in a releasable manner.

[0025] Internal thread of box member 10 has stab flanks, load flanks, roots, and crests. The thread increases in width progressively at a uniform rate in one direction over substantially the entire helical length of thread. External thread of pin member 12 has stab flanks, load flanks, roots, and crests. The thread increases in width progressively at a uniform rate in the other direction over substantially the entire helical length of thread. The oppositely increasing thread widths and the taper of threads, cause the complementary roots and crests of the respective threads to move into engagement during make-up of the connection. Root and crest engagement is followed by the moving of complementary stab and load flanks into engagement upon make-up of the connection. The moving of complementary flanks, roots and crests into engagement forms sealing surfaces that resist the flow of fluids between the threads. A positive stop torque shoulder is located at either the interface of the box face/pin OD shoulder 20 or the pin nose/box ID shoulder 22. The type of torque shoulder used and the sealing mechanisms associated with the connection will be discussed in detail below with reference to FIGS. 4a-d, 5a-e, and 6a-f.

[0026] The positive stop torque shoulder may move into engagement upon make-up of the connection. The positive stop torque shoulder engagement may occur simultaneously with the stab and load flanks moving into engagement. Alternatively, the stab and load flanks may move into engagement after root and crest engagement during make-up of the connection and followed by the positive stop torque shoulder engagement upon make-up of the connection. In a preferred embodiment, the internal and external thread widths are selected so that a selected clearance exists at least between the internal and external load and stab flanks, upon engagement of the positive stop torque shoulder. In this arrangement, torque